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ABSTRACT

Several sets of evidence are offered to support the hypothesis that cognitive and social development are intimately interrelated, and that mother-infant interaction influences both. A mother's prompt responsiveness to her baby's signals tends to foster the development of varied and clear modes of communication and thus the development of one facet of social competence. Sensitive maternal responsiveness to infant signals, especially when combined with giving a baby freedom to explore his physical environment facilitates overall development of competence as measured by a general intelligence quotient. The quality of mother-infant interaction affects both the quality of a baby's attachment relationship with his mother and at least one important specific aspect of cognitive development, the development of the concept of the object. The concept of the balance between exploratory and attachment behavior is considered, and it is suggested that the significance of this is not so much quantitative as qualitative. That is, the significant individual differences lie not so much in the relative quantities of attachment and exploratory behavior as in the quality of each and the smoothness of transition from one to the other. Evidence is presented that the quality of mother-infant interaction influences the quality of the infant's attachment relationship to his mother, and that it also influences the level and quality of exploratory behavior and play. (Author/CK)

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MOTHER-INFANT INTERACTION AND THE DEVELOPMENT OF COMPETENCE

Mary D. Salter Ainsworth and Silvia M. Bell

Competence in infancy may be defined in three major ways, and in each case it is illuminating to consider the neonate as well as the somewhat older infant. First, competence may be defined in absolute terms of cognitive and motor skills and abilities. In these terms an infant, especially a neonate, must be assessed as incompetent and helpless, both absolutely and when compared with an older child or adult. At the beginning, for example, he cannot reach out and grasp an object that interests him. He becomes more competent later when he can do so, and his competence in this regard can increase as his speed, precision, and control increases. This definition of competence is obviously useful when one is concerned with a child's development towards adult ability. On the other hand, it tends to minimize the effectiveness of an infant's behaviour and to neglect the extent to which it is preadapted to perform vital biological functions.

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The second definition implies age- or stage-relevant assessment. An infant is competent to the extent that he functions well in the various situations that an infant normally encounters. As a neonate his competence rests on the adequacy of patterns of reflex activity (reflex schemata, or fixed action patterns), and hence upon the integrity of his neural, muscular, and sensory equipment. A competent neonate thus, for example, sucks well and cries lustily; a relatively incompetent one might suck or cry weakly. This view gives an infant his due as an infant, and also takes into account the fact that much of his competence rests, particularly at the beginning, upon the efficiency of his preadapted equipment. According to this view competence is most

appropriately assessed relative to age peers. This is, of course, the core of the age-scale principle of assessing intelligence; it has been a useful principle. Its chief shortcoming as applied to infancy is that a baby's preadapted behaviours cannot be effective in performing the functions forwhich they were selected (in an evolutionary sense) should his environment depart unduly from the environment to which they were originally adapted. Thus it matters little how well a baby cries or roots or sucks if no one heeds the signal of his crying, and no one picks him up and makes a nutritive nipple available enough that he can find it and suck it.

A third view of competence views neonatal patterns as adapted to an environment that contains an accessible mother figure whose responsive reciprocal behaviour is to a substantial extent under the control of the infant's behaviour. This implies that at first an infant's competence rests, in most essential respects, upon the cooperation of his mother figure. This defines infant competence as his effectiveness; an infant is competent to the extent that he can, through his own activity, control the effect that his environment will have on him. This definition includes such matters as controlling when and how he is fed and control of his proximity to companions, as well as control of the continuation or recurrence of interesting sights and sounds or control of reaching out and grasping an interesting object.

This definition of competence implies a competent mother-infant pair--an infant who is competent in his preadapted function (as in our second definition) and a mother who is competent in the reciprocal role to which the infant's behaviour is preadapted. The infant in such a competent pair is effective in getting what he wants at least in part because he can influence the behaviour of a responsive mother. It is

our hypothesis that this fosters the further growth of the competence of the infant himself, both in absolute terms and in terms of increasing skill in enlisting the cooperation of others. According to this view, an infant who is initially relatively incompetent in the sense of inefficient function may, when paired with a mother highly responsive to the signals implicit in his behaviour, gradually increase his effectiveness in dealing with his environment, both physical and social. On the other hand, an infant, competent enough in his preadapted behaviours, may be ineffective in getting what he wants, if paired with a mother unresponsive to his signals. As a pair, this couple is relatively incompetent. The infant himself, although competent in his initial functioning, is ineffective; this initial ineffectiveness tends to hamper the further development of his sensorimotor and social skills, and hence adversely affects the development of competence relative to his more favoured age-peers. Finally, of course, an initially malfunctioning infant may be paired with an unresponsive mother; this is the condition with the poorest prognosis for the development of infant competence. In the ultimate biological terms of survival this third view of competence is the crucial one.

Furthermore, one facet of competence, important throughout the entire life span, is social competence--the ability of the person to elicit the cooperation of others. According to our third definition of competence, maternal responsiveness provides the conditions for a normally functioning infant to influence what happens to him by influencing the behaviour of his mother. This, we believe, fosters a general "sense of competence" (White, 1963), and a sense of competence--or confidence--influences the development of increased competence in other realms, whether viewed

in age-relevant or in absolute terms.

Crying, Communication, Maternal Responsiveness and Social Competence

Focal to social competence is effective communication. So let us begin by considering communication in mother-infant interaction--to which Richards (this volume) attributes primary significance. Perhaps the most important contributions an infant first makes to mother-infant interaction are his signalling behaviours, especially crying, through which he can attract his mother from a distance into closer proximity. Although to a sensitive mother an infant's entire behavioural repertoire may have signalling value, it can scarcely perform this function if she is not close enough to perceive his other signals--hence the special significance of crying as a signal.

These early signals at first imply no intent to communicate. It seems unlikely that communication can become fully intentional until Stage 4 of the sensorimotor period (Piaget, 1936) or until there is a shift from fixed-action patterns to goal-corrected behaviour (Bowlby, 1969)--that is, not until the last three or four months of the first year. Nevertheless, long before an infant can intentionally seek to influence the behaviour of his companions, he does in fact exert a measure of control through the expressive, signalling quality of his behaviour. Through interaction with them his signalling behaviour may become increasingly differentiated and effective in influencing their response to him.

Elsewhere (Bell & Ainsworth, in press) we have presented findings pertinent to the argument that the responsiveness of a mother figure to infant signals promotes the development of infant communication--and hence the development of social competence. These findings emerged from a short-term longitudinal study of the development

of infant-mother attachment in the first year of life. The subjects were 26 infant-mother pairs from white, middle-class, Baltimore families. They were observed in their own homes at intervals of three weeks, each visit lasting approximately four hours. The raw data are in the form of detailed narrative reports. A variety of coding, rating, and classificatory procedures have been used in the data analysis.

The signalling behaviour that concerned us in the above-mentioned analysis was crying. Each instance of crying that occurred in the course of a home visit was coded. Among the particulars coded were: the duration of the cry, whether the mother responded to it or ignored it, and, if she responded to it, how long she delayed before responding. We were interested in ascertaining whether a mother's responsiveness was associated with a change in the incidence and duration of infant crying in the course of the first year. We were also interested in teasing out the direction of effects--a difficult matter in a naturalistic study which must use correlational procedures.

First, a word about our procedures. Our infant crying measures included fussing as well as crying, and very brief cries as well as full-blown, prolonged crying. There were two measures of infant crying: (a) the frequency of crying episodes per waking hour, and (b) the total duration of crying in minutes per waking hour. The two measures of maternal responsiveness that are relevant to this report are: (a) the number of crying episodes that a mother altogether ignored, and (b) the duration of maternal unresponsiveness--the length of time in minutes per waking hour that a baby cried without or before an intervention by the mother.

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The first step in our analysis was to examine the stability of infant crying throughout the first year and to compare it with the stability of maternal responsiveness

to crying over the same period. Do infants who cry relatively frequently at the beginning continue to cry relatively frequently throughout the first year? Are there constitutional differences in irritability that make some infants cry more than others both at first and throughout the first year? Our findings suggested that there is no stability in infant crying until the very end of the first year, and therefore no support for the view that babies who cry more than others at the end of the first year do so because they are constitutionally irritable.

Mothers were found to be substantially more stable in their responsiveness to infant crying than infants in their tendency to cry. Their responsiveness in each quarter-year was significantly related to their responsiveness in the previous quarter. This stability was particularly striking in regard to the duration measure--the length of time a baby cried without or before maternal intervention; the first and second quarters, as well as the third quarter, were significantly correlated with the fourth quarter.

The second step was to consider the intercorrelations between infant crying and maternal responsiveness. Table 1 shows the correlations between the number of

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crying episodes ignored by the mother and the frequency of infant crying episodes. There are three parts of the table upon which to focus. The first is the diagonal, which gives the correlation of maternal behaviour and infant behaviour in the same quarter. The second is the six-celled lower left portion of the matrix, which shows the correlation of maternal behaviour in each quarter with infant behaviour in subsequent quarters.

Let us first consider the information on the diagonal. Here it was necessary to introduce a correction for the confounding of measures. The confounding consists in the fact that the number of crying episodes (within a quarter) includes those that the mother ignored as well as those to which she responded. The correction consisted of excluding from the infant measure those episodes that the mother ignored. After this correction is made it is evident that the extent to which a mother ignores crying and the frequency with which an infant cries are not significantly related either within the first or within the second quarter. Within each of the third and fourth quarters, however, babies who cry more frequently have mothers who more frequently ignore their crying.

The lower left portion of the matrix shows that from the beginning of the first year maternal ignoring in each quarter correlates significantly with infant crying in the subsequent quarter. (A correction was not necessary here, because the frequency with which a baby cries in one quarter is not confounded with the number of episodes which his mother ignores in another quarter.) Thus tiny babies do not respond immediately to maternal ignoring by crying more frequently, but from the end of the third month onward they tend to be more insistent in their crying as a result of the past history of mother's ignoring tactics. Finally, the upper right hand portion of the matrix suggests that there is no consistent tendency for an infant's crying in one quarter to be associated with maternal ignoring in the following quarter, until the fourth quarter. These findings, together with the findings on stability, summarized earlier, suggest that maternal ignoring increases the likelihood that a baby will cry relatively more frequently from the second quarter onward, whereas the frequency of <u>his</u> crying has no consistent influence on the number of episodes his mother will be likely subsequently to ignore.

Table 2 shows a comparable analysis of the relation between the duration of

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maternal unresponsiveness and the duration of infant crying. For intra-quarter comparisons--those shown on the diagonal--there was again a correction for confounding, since the duration of an infant's crying includes both the time during which his mother was unresponsive and the time he continued to cry after she intervened. The corrected measure deals only with the time he cried after she intervened. When this measure is used, it may be seen that babies whose mothers are unresponsive in the first quarter do not cry more (after intervention) than those whose mothers are responsive, but within each of the second, third and fourth quarters babies with unresponsive mothers do cry more.

For interquarter comparisons there is no confounding of measures and hence no correction. The lower left portion of the matrix shows that babies whose mothers were unresponsive in the first quarter tend to cry more in subsequent quarters, and that, generally, maternal unresponsiveness in one quarter is associated with longer duration of crying in subsequent quarters. The upper right-hand cells differ, however, from those of the previous table. It appears that by the second half of the first year infants' persistently long crying tends to make mothers more than ever reluctant to respond. This suggests that a vicious spiral may have been established. Mothers who are unresponsive to the crying of their tiny infants have babies who cry more later on, which in turn further discourages the mother from responding promptly, and results in relatively increased infant crying.

These findings are of considerable interest in themselves, perhaps especially

since they fail to confirm the common belief that to respond promptly to a baby's cry will strengthen his tendency to cry on subsequent occasions. But let us consider the findings within the context of the various concepts of competence. Even though crying may be age-appropriate at the beginning of the first year, substantially diminished crying is appropriate towards the end of the first year--and later. It is evident that maternal unresponsiveness to crying does not diminish it. On the contrary, it tends to prolong this primitive form of signalling up to at least the end of the first year. If, however, an infant's competence is viewed as depending on his mother's cooperativeness, one might argue that a one-year old (albeit to a lesser extent than a neonate) still must be able to signal effectively if he is to be deemed competent. What has happened to the signalling behaviour of infants whose mothers have been relatively responsive?

This question led us to assess infant communication in the fourth quarter of the first year. A seven-point rating scale was constructed, which took into consideration facial expression, gesture, and non-crying vocalizations. At the positive pole of the scale was a wide variety of subtle yet clear modes of communication (as described by the observer in his narrative report, and without taking into account maternal response to the communication.) At the negative pole was limited variety in modes of signalling, and signals that were difficult to "read." (The seven-point scale was subsequently collapsed into a three-point scale, in the interests of obtaining good inter-rater agreement, but the poles retained this definition.) Table 3 shows the relationship between our ratings of communication and infant crying on the one hand and maternal responsiveness on the other. It may be seen that there are substantial

negative correlations between infant communication and the frequency and duration

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Insert Table 3 about here

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of crying. Babies who cried little had a wider range of differentiated modes of communication than did babies who cried much. Furthermore, it is clear that those mothers who were responsive to infant crying, ignoring few episodes and responding with little delay, have infants who have more variety, subtlety and clarity of non-crying communication.

It is not suggested that this relationship is entirely attributable to maternal responsiveness to crying. There is good reason to believe that those mothers in our sample who are relatively responsive to crying are also responsive to a wide range of other infant signals. We assessed such responsiveness by a rating scale designed to measure a mother's sensitivity-insensitivity to infant signals. (The rating scale is reproduced in Ainsworth, Bell & Stayton, in press.) Sensitivity-insensitivity ratings have significant negative correlations with maternal ignoring of crying episodes ($r = -.41$; $p < .05$) and with duration of maternal unresponsiveness to crying ($r = -.58$; $p < .01$). It therefore seems likely that it is a mother's responsiveness to non-crying signals as well as to the more obvious and urgent crying signals that facilitates the development of a differentiated repertoire of non-crying modes of communication. Thus maternal responsiveness to signals supports the development of social competence, in the sense that it promotes the development of a variety of communicative behaviours that are easy to read and hence are likely to influence the behaviour of others in a more differentiated way than an infant can through merely crying.

Competence in Direct Dealing with the Physical Environment

Important though social competence may be, it may be asked further in what ways mother-infant interaction may influence those aspects of cognitive development that imply direct interaction with the physical environment and gaining control over it, rather than the more indirect control that may be gained through influencing the behaviour of other people. There seem to be at least three important ways in which mother-infant interaction might influence the development of an infant's competence in direct interaction with his physical environment and the objects in it.

First, it seems reasonable to suppose that maternal behaviour might facilitate the development of abilities directly pertinent to an infant's dealings with his physical environment. Thus, for example, in the course of being held by his mother, his adjustment of posture to the shifts of position occasioned by her movements might well accelerate the acquisition of control over head and trunk musculature, which in turn would accelerate the development of locomotion, and consequent exploration and manipulation of his physical environment. Similarly, it has been suggested (Piaget, 1937, 1954) that the mother, in the course of interacting with him, is the one object who can serve as "aliment" simultaneously to many of the infant's schemata, and thus promotes their intercoordination and his general development. It can be further argued (Bell, 1971) that the mother's initiative in introducing her child to stimulating conditions through play has an increasingly important role in the course of cognitive development from the end of the first year of life onwards.

Second, even when she is not in interaction with him, a mother may substantially influence the kind of experience an infant can have with his environment. For example,

she may provide interesting objects for him to see when he is lying in his crib rather than a barren visual surround; she may tuck him up so his hands are not free, or leave him free to use his hands. When he has become mobile, she may give him freedom to explore interesting facets of his environment, or she may confine him in a playpen.

Third, a baby's experience with his mother may have an indirect effect on his dealings with the rest of his world through affecting his confidence. This confidence has at least two noteworthy aspects--confidence in her and confidence in himself. Trust in her may well be a necessary condition for him to venture forth to explore the world--and this will be discussed later. Confidence in himself may also be affected by his experience with her, through fostering a "sense of competence." It seems reasonable to suppose that the more consistently an infant has experienced effective control of what happens to him as a consequence of his own activity, the more likely he is to approach a new object or new situation with the expectation that he can control its effects on him. Thus it seems likely that an infant whose mother's responsiveness has given him frequent experiences of affecting what happens to him (through affecting her behaviour) would have influenced his confidence in his ability to act effectively on his environment.

When attempting to ascertain the effect of maternal behaviour on the development of an infant's competence, it is very difficult to sort out those specific aspects of her behaviour that may have been responsible for any specific effect that might be attributed to her. Despite this difficulty, there are a few findings from our investigation of the development of infant-mother attachment and related studies that suggest generally that maternal behaviour can influence the development of infant competence.

Maternal Behaviour and Infant I.Q.

The first of these findings relates to infant intelligence as measured by the Griffiths (1954) Scale. Whether or not such measures predict later I.Q. at least they may be accepted as valid assessments of developmental level in infancy, and, as such, may be considered overall measures of the level of competence an infant has achieved. In the course of our longitudinal study of the development of infant-mother attachment, the Griffiths test was administered at intervals of about every nine weeks during the first year. The measure that concems us here is the mean "General Quotient" for the testings undertaken in the fourth quarter-year.

The analysis of the relationship between maternal behaviour and infant I.Q. is a reworking of the correlational matrix presented by Stayton, Hogan, and Ainsworth (1971), which was concerned with the relationship of infant obedience and infant I.Q. The correlational matrix is shown in Table 4. The first three variables were measured by 9-point rating scales. Maternal sensitivity-insensitivity to infant signals was mentioned earlier. It and the other two--acceptance-rejection and cooperation-interference--were described briefly by Stayton, Hogan, and Ainsworth. The frequency

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Insert Table 4 about here

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of mother's verbal commands and the frequency of her physical interventions in lieu of or to reinforce commands were derived from coding and refer to the mean number of such behaviours per visit. Floor freedom refers to the degree to which a baby was permitted to be free on the floor during his waking hours; two groups were distinguished--those given relatively much and those given relatively little floor freedom. It may be seen that four of the six maternal variables have a significant, moderate, positive

relationship with infant I.Q.--floor freedom and the three rated variables.

Table 5 shows the results of a stepwise multiple regression using these six maternal variables, with infant I.Q. as the criterion variable. Although all three rated variables--sensitivity-insensitivity, acceptance-rejection, and cooperation-interference--were significantly related to infant I.Q. they were so highly correlated with each other that the addition of a second or third to the regression equation effected little or no increase in the multiple correlation coefficient. But when floor freedom was added to the first of the rated variables--maternal sensitivity-insensitivity--the R was raised to .63. The addition of two other variables raised the multiple correlation

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Insert Table 5 about here

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coefficient to .70, and the addition of the last two variables effected no further increase.

The correlation matrix in Table 4 was not originally assembled with the prediction of infant I.Q. in mind, and obviously omits a number of variables that ought to be included in such an analysis, for example, parents' education and occupation, stimulating nature of physical environment provided in the home, and parental encouragement of the acquisition of verbal and motor skills. Nevertheless the findings of the stepwise regression analysis are suggestive. Mothers who both are sensitive to infant signals and permit their babies freedom to move about to explore the world on their own account tend to have babies who are relatively accelerated in psychomotor development, whereas mothers who are insensitive to signals and who limit their infants' opportunity to interact with their physical environment tend to have babies who are relatively retarded in development.

The contribution of floor freedom to the development of competence seems

obvious. The contribution of maternal sensitivity to signals is perhaps less immediately apparent. It suggests that the behaviour characteristic of the sensitive mother has, as Piaget proposed, a facilitating effect on the development of the infant's ability to deal with his physical environment. It also fits the hypothesis, advanced earlier, that a baby whose signals are responded to promptly and appropriately builds up a sense of competence--a confidence that he can through his own activity control what happens to him--and this confidence carries over into his transactions with his physical environment.

Substantial confirmation of these findings comes from two sources. First, Beckwith (1971) studied 24 adoptive infants living in middle-class families, in order to control possible confounding of genetic effects and maternal behaviour. She used two composite measures of maternal behaviour derived from time-sampled observations during home visits. One measure was "stimulation" which combined scores on verbal and physical contact; another was a measure of restrictiveness of exploration. A highly significant relationship was found between these measures and Cattell intelligence scores. Low maternal verbal and physical contact plus high maternal restrictiveness of exploration significantly lowered I.Q.

Second, one of us (SMB), in the course of a longitudinal study of 33 black socio-economically underprivileged children, obtained findings of the relation between the quality of the infant-mother attachment, floor freedom and I.Q. that closely parallel those outlined above. The children in this study were tested repeatedly during the first two years of life on several measures of cognitive development--the Griffiths Scale, and two tests of the object concept. In addition they were observed in free

play and in interaction with their mothers for a two-hour period subsequent to each testing. An infomal interview was also conducted with the mother in each session, for the purpose of evaluating the stimulating potential of the home environment, parental education, and other pertinent factors. The findings relevant to the concern of this paper are presented in Table 6, and show the correlation between I.Q. at two

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Insert Table 6 about here

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age levels, some of the variables assessed in interview, and a measure of the observed quality of the infant-mother attachment relationship.

At both 8 and 11 months, floor freedom and a harmonious infant-mother attachment relationship were found to be highly correlated with I.Q. Availability of toys also showed a significant, but lower, correlation with I.Q. at both age levels. Amount of time that adults or other children spent in playing with the baby was positively correlated with I.Q. towards the end of the first year. Frequency of punishment was negatively and moderately correlated with development at 11 months. Parental education, in contrast, was not significantly correlated with infant I.Q. at either 8 or 11 months.

This table presents only a part of the total matrix of variables reported by Bell (1971). The larger matrix was subjected to a factor analysis, with Varimax rotation. The first factor, which accounted for 52 per cent of the variance, was defined primarily by high loadings on the cognitive tests, including I.Q., at the two age levels, the quality of the infant-mother attachment relationship, and floor freedom. Availcbility of toys at 11 months loaded primarily, but only moderately, on this factor. Since the quality of the infant-mother attachment relationship, observed in this study, is largely

a function of the degree of maternal sensitivity characteristic of the transactions between mother and infant (Bell, 1970) the findings corroborate the conclusions of Ainsworth's and Beckwith's studies reported above.

The Use of the Mother as a Secure Base from which to Explore

We have often emphasized one significant outcome of infant-mother attachment, namely, that an infant can use his mother as a secure base from which he can explore his world (Salter, 1940; Ainsworth, 1967; Ainsworth & Bell, 1970; Ainsworth, Bell & Stayton, 1971). The fact that a baby has become attached to his mother does not mean that he constantly seeks to be in contact, close proximity, or even in interaction with her. On the contrary, he may leave her often on his own initiative and may move about, interested in investigating his surroundings and the objects and other people in it. He keeps track of his mother's whereabouts, however, and tends to return to her briefly from time to time before moving off again. He may go out of sight in the course of his explorations, showing no sign of fear, presumably because he knows where his mother is and expects her to remain accessible to him. But should his mother get up to leave the room, he may well abandon his explorations and scuttle after her, or perhaps merely gravitate to where she now is. It is her presence that provides him with a secure base from which to explore.

The secure-base phenomenon may be viewed within the context of Bowlby's (1969) control-systems model of attachment behaviour. There are at least two systems of behaviour that are in dynamic balance with each other--attachment behaviour that promotes proximity to an attachment figure and exploratory behaviour (including locomotion, manipulation, visual investigation, and exploratory play) that

promotes acquisition of knowledge of the environment and adaptation to environmental variations. The balance is tipped towards exploration by complex, novel, or changing features of the environment, provided that these are not so sudden, intense, or strange as to provoke alarm. The balance is tipped towards proximity seeking by a number of conditions, both intraorganismic and environmental. Important among the environmental conditions that heighten a child's attachment behaviour are alarm and threatened or actual separation from the attachment figure. Obviously, if attachment behaviour were constantly activated at a high level, a child's development would be greatly hampered, for he would not be attracted away from his attachment figure to explore his world. Perhaps not so obviously, if his exploratory behaviour constantly overrode his attachment behaviour, his survival would be threatened unless his mother were constantly vigilant to retrieve him from danger.

An optimum balance between exploratory and attachment behaviour would seem to be a favorable condition for cognitive development and, thus, for the development of competence. It is by no means easy to study the attachment-exploration balance, however. Our first attempt to do so prompted us to devise a strange-situation procedure (Ainsworth & Wittig, 1969). When observing a baby at home it was not clear whether it was his mother who was providing the secure base for his exploration or his whole familiar home environment. In an unfamiliar laboratory situation, however, it was intended to tip the balance towards exploration by providing an attractive display of toys at a distance from the mother. If a baby left his mother to explore the toys when she was present and ceased to explore when she was absent, it could be inferred that her presence provided security for his exploration. A majority of one-year

olds, both in our longitudinal sample and in Bell's (1970) project, did in fact behave as our hypothesis suggested they would (Ainsworth & Bell, 1970). There were striking individual differences, however, especially (a) in the extent to which attachment behaviour replaced exploratory behaviour during the brief separation episodes of the strange situation and in the reunion episodes that followed, and (b) in the intensity and quality of attachment behaviour in the reunion episodes.

Babies were classified into three groups chiefly in terms of their attachment behaviour in the reunion episodes (Ainsworth, Bell, & Stayton, 1971). Group A infants tended neither to maintain contact with the mother nor to seek proximity to her even in the reunion episodes following brief separation, but rather conspicuously avoided proximity to her and interaction with her. Group B infants' attachment behaviour was heightened by separation; in the reunion episodes they actively sought to be near the mother, to gain and to maintain contact with her, or, at least to establish interaction with her. The attachment behaviour of Group C infants was also heightened by separation but was of highly ambivalent quality.

In an attempt to throw light upon these individual differences, assessments were made of the behaviour of mother and infant at home. Maternal behaviour was rated on four nine-point rating scales--sensitivity-insensitivity to infant signals, acceptance-rejection, and cooperation-interference, which were mentioned earlier, and also accessibility-ignoring. Whereas all the mothers of Group B infants were above the median on each of four scales, the mothers of both Group A and Group C infants were below the median on all scales. Group A mothers were especially rejecting, whereas Group C mothers were not, although they were either strongly interfering or

very inaccessible.

In regard to infant behaviour we tackled the difficult job of assessing attachment-exploration balance as it appeared in behaviour in the familiar home environment. In advance of this analysis symmetrical findings were expected, with a majority showing a smooth balance between attachment and exploratory behaviour but with some having the balance tipped towards exploratory behaviour with less than average attachment behaviour, and others having the balance tipped towards attachment behaviour with less than average exploratory behaviour. The findings (reported by Ainsworth, Bell, & Stayton, 1971) did not turn out precisely according to expectation. It seemed to be not so much the quantitative ratio of exploratory to attachment behaviour that was significant as the smoothness of the transition from one to the other, and the quality of the attachment behaviour when it was activated.

The strange-situation classification showed remarkable congruence with the classification of attachment-exploration balance at home. At home all but one of the 13 Group B babies showed at least a fairly smooth kind of transition between exploratory and attachment behaviour. They were not especially clingy; they enjoyed physical contact with their mothers when it occurred, but they were content to be put down and to move off into independent activity. They tended to follow their mothers about in a casual way, but tended not to be distressed by minor everyday situations in the familiar home environment. Three infants (two A and one B) did seem to have the balance tipped towards exploratory behaviour with relatively infrequent attachment behaviour. But the 8 remaining subjects (four A and four C) seemed not so much to show below average exploratory behaviour as disturbances in the infant-mother attachment

relationship. Their attachment behaviour was ambivalent, and they were more insecure than the average, crying relatively frequently, and especially prone to separation anxiety.

One of us (SMB) is currently investigating the quality of investigative behaviour and exploratory play, and its relation to maternal behaviour and to the quality of the infant-mother attachment relationship. In the course of the study of cognitive development of black underprivileged children mentioned earlier (Bell, 1971), infants were observed with their mothers in a free-play situation for a two-hour period several times in the first three years of life. Each session was subsequently coded for infant exploration and for maternal behaviour. The coding of infant exploration consisted of: (a) noting all the behaviours produced by the child and all the toys explored in the course of the session, and (b) ascertaining the number of different schemata exhibited and the cognitive level of the play. The coding of maternal behaviour referred primarily to: (a) the qualitative and quantitative engagement of the mother with the toys and the child during his exploration, and (b) the quality and quantity of her transactions with him unrelated to his exploration. The analysis of these data is still underway, but results obtained for the last quarter of the first year indicate that there is a substantial relationship between an infant's competence and his mother's behaviour. Infants who had frequent harmonious transactions with the mother in the course of the play session, and whose mothers were generally responsive to their initiations of interaction (whether directly related to exploration or not), tended to explore more toys and, more important, to display more behavioural schemata in the course of play. In addition, infants who experiencedfrequent prolonged

periods of play with the mother, or main caretaker, outside the observed play session, explored more toys and displayed a greater number of schemata and a more advanced level of play (in the play session itself) than did infants whose mother figures did not characteristically spend time playing with them. The findings of this study suggest that variety of exploration and level of behavioural repertoire are associated with the general quality of the infant-mother relationship and also with the amount of time that a child spends in play and in one-to-one interaction with a significant attachment figure.

Mother-infant Interaction and the Development of the Concept of the Object

One of us (Bell, 1970) compared the course of development of the concept of inanimate objects as permanent with the course of development of the concept of persons as permanent objects. A scale of object permanence was developed, based on Piaget's (1937) detailed observations, and a parallel scale of person permanence. The subjects were 33 infants of white, middle-class families who were tested on these two scales three times between the ages of 8-1/2 and 11 months. Attention was directed toward the horizontal decalage between the two measures of development of the object concept. The hypothesis was that infants who had enjoyed relatively harmonious interaction with their mothers in the course of the first year would be accelerated in person permanence in contrast with the concept of permanence of inanimate objects, while the reverse would hold for infants who had experienced relatively disharmonious interaction. The assessment of the degree of harmony of mother-infant interaction was indirect; the strange-situation technique was used to classify the infants, and, as has been reported earlier (pages 000-000), it is clear that Group B infants have more harmonious mother-infant interaction than do either Group A or Group C infants.

Twenty-four of the 33 infants in this sample could be classified in Group B in regard to strange-situation behaviour. Twenty-three of these had a positive décalage, being more advanced in the development of person permanence than in the development of the concept of the permanence of inanimate objects. One of them showed no décalage. None of the babies classified in either Group A or in Group C had a positive décalage. Four Group A babies showed a negative décalage, and one no décalage. Three Group C babies showed a negative décalage, and one no décalage. It was concluded that babies who have had a harmonious interaction with mothers sensitive to their signals, and who have developed an attachment relationship of normal quality, tend to develop person permanence in advance of inanimate-object permanence.

Once the relationship between the type of décalage and quality of attachment had been established, it was of interest to determine if those babies who had a positive décalage differed from the others in terms of the maximum level of the object concept they had achieved. For this analysis the negative and no décalage groups were combined. Figure 1 shows the mean scores on person permanence and object permanence

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Insert Figure 1 about here

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at 8-1/2 and 11 months. At both ages it may be seen that the person-permanence scores of the positive décalage group are significantly in advance of the object-permanence scares of the negative and no décalage group. At 8-1/2 months the positive décalage group was facile in coping with the visible displacements of persons, and thus had nearly reached stage 6 in person permanence, although they were just beginning stage 5 in object permanence. The negative and no décalage group was not significantly better in object permanence, and had scarcely begun to search for hidden persons,

and hence were at the beginning of stage 4 in person permanence. By 11 months the majority of babies in the sample had begun to cope with invisible displacements of inanimate objects and thus had entered stage 6. Babies in the positive décalage group had also completed the higher substages of stage 6 in regard to person permanence, and thus had acquired an ability to handle complex invisible displacements of one type of object. About half of the babies were retested at 13-1/2 months. Of these, a significantly higher number in the positive décalage group had either completed the object-permanence scale than in the negative-no décalage group (Fisher, $p < .01$). In addition, the rate of development with respect to both object and person permanence was found to be significantly faster for the positive décalage group (Fisher, $p < .05$). This study indicated that the environmental circumstances that affect the quality of an infant's attachment to his mother--namely, maternal characteristics of perceptiveness, appropriateness and contingency of responding subsumed under the label "sensitivity"--affect also an important aspect of cognitive development in the first two years of life.

Continuing with her work in this area, Bell undertook a study to evaluate the importance of the mother-infant relationship in affecting cognitive development, relative to ethnic and socio-economic factors. One aspect of the project (Bell, 1971), which was outlined in an earlier section of this chapter, aimed to study black underprivileged infants using procedures similar to those utilized in the (1970) study of white, middle-class infants. The results of the second study directly parallel those obtained in the first. There was a perfect correspondence between type of décalage and quality of infant-mother attachment; only those infants who had a positive décalage had had a harmonious relationship with the mother. Those infants who had a positive décalage were

significantly more advanced in the development of the object concept than were the negative-no decalage group.

In addition, a comparison of the middle-class and socio-economically deprived samples revealed no differences in the level of the object concept at 8 months, but significant differences in the level of both object and person permanence at 11 months, differences which favoured the middle-class sample (t significant at $< .01$ level for both tests). But when the décalage subgroups were compared across socio-economic level, there were no differences in the level of the object concept at either 8 or 11 months for those infants who had a positive décalage and had experienced a harmonious relationship with the mother. On the other hand, those infants in the low socioeconomic sample who had experienced a disharmonious relationship with the mother were significantly inferior to the middle-class infants who had experienced disharmony. These findings suggest that, whereas the environmental conditions associated with socio-economic deprivation have a detrimental effect on cognitive development, a harmonious infant-mother relationship can act as a buffer protecting a child from their detrimental effect, and, in fact, is the single most important factor alleviating socio-economic disadvantage.

Summary

Several sets of evidence have been offered to support the hypothesis that cognitive and social development are intimately interrelated, and that mother-infant interaction influences both. A mother's prompt responsiveness to her baby's signals tends to foster the development of varied and clear modes of communication and thus the development of one facet of social competence. Sensitive maternal responsiveness to infant signals,

especially when combined with giving a baby freedom to explore his physical environment, facilitates overall development of competence as measured by a general intelligence quotient. The quality of mother-infant interaction affects both the quality of a baby's attachment relationship with his mother and at least one important specific aspect of cognitive development, the development of the concept of the object. The concept of the balance between exploratory and attachment behaviour has been considered, and it has been suggested that the significance of this is not so much quantitative as qualitative. That is, the significant individual differences lie not so much in the relative quantities of attachment and exploratory behaviour as in the quality of each and the smoothness of the transition from one to the other. Evidence has been presented that the quality of mother-infant interaction influences the quality of the infant's attachment relationship to his mother, and that it also influences the level and quality of exploratory behaviour and play. These findings from one set of related studies have accomplished little more than to demonstrate a relationship between mother-infant interaction and the development of competence. Further research is presently under way to yield more detailed knowledge of which specific aspects of the mother-infant interaction interact with other variables, both environmental and organismic, to affect the development of specific aspects of competence.

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Table 1

Episodes of Crying Ignored by the Mother

and Frequency of Crying

Frequency of crying	Episodes ignored by the mother			
	First quarter	Second quarter	Third quarter	Fourth quarter
First quarter	-.04	.34	.48*	.21
Second quarter	.56**	.35	.32	.29
Third quarter	.21	.39*	.42*	.40*
Fourth quarter	.20	.36	.52**	.45*

Note: The figures underlined have been corrected to avoid confounding.

* $p < .05$ ** $p < .01$

Table 2

Duration of Mother's Unresponsiveness to Crying

and Duration of Crying

Duration of crying	Mother's unresponsiveness			
	First quarter	Second quarter	Third quarter	Fourth quarter
First quarter	<u>.19</u>	.37	.12	.41*
Second quarter	.45*	<u>.67**</u>	.51**	.69**
Third quarter	.40*	.42*	<u>.39*</u>	.52**
Fourth quarter	.32	.65**	.51**	<u>.61**</u>

Note: The figures underlines have been corrected to avoid confounding.

* $p < .05$ ** $p < .01$

Table 3

Infant Communication in the Fourth Quarter,

Crying and Maternal Responsiveness

	Fourth quarter infant communication
Duration of crying	-.71**
Frequency of crying	-.65**
Mother's unresponsiveness	-.63**
Episodes ignored by mother	-.54**

** $p < .01$

Table 4

Intercorrelations between Maternal Variables and Infant I.Q.

	Variables	1	2	3	4	5	6
1.	Sensitivity-insensitivity	...					
2.	Acceptance-rejection	.91**	...				
3.	Cooperation-interference	.87**	.88**	...			
4.	Freq. verbal commands	-.14	-.05	-.35	...		
5.	Freq. physical interventions	-.44*	-.38	-.59**	.62**	...	
6.	Floor freedom	.07	.00	.10	-.03	.07	...
7.	Infant I.Q.	.46*	.45*	.44*	.06	.06	.46*

* $p < .05$

** $p < .01$

Table 5

Stepwise Multiple Regression: Infant I.Q. as Criterion Variable

Step Number	Variable Entered	R with I.Q.
1	Sensitivity-insensitivity	.46
2	Floor Freedom	.63
3	Freq. physical interventions	.67
4	Cooperation-interference	.70
5	Acceptance-rejection	.70
6	Freq. verbal commands	.70

Table 6

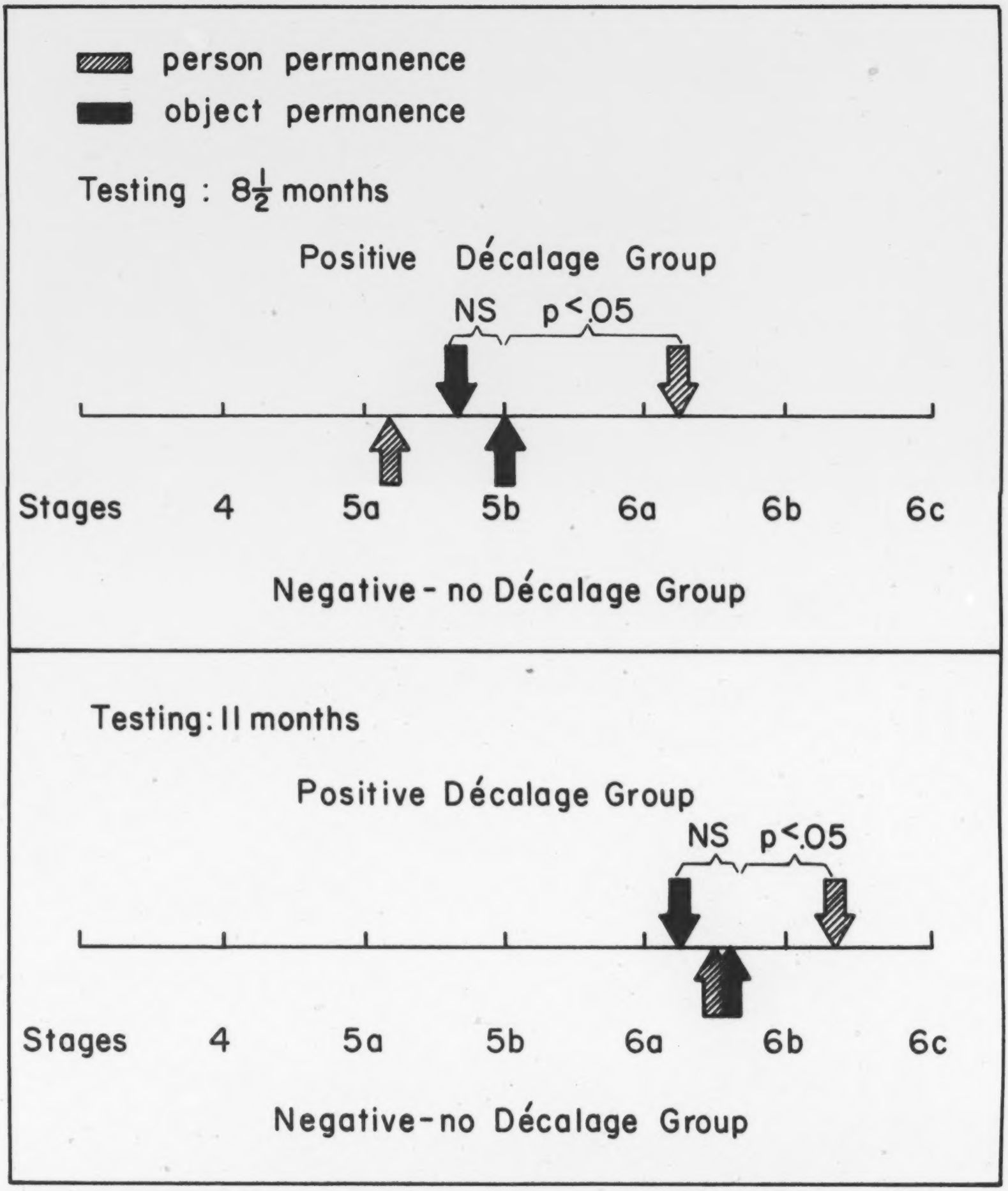
Correlation of I.Q. at two age levels with: stimulating potential of the environment, quality of the infant-mother attachment and several variables of maternal care

	I.Q. 8 months	I.Q. 11 months
Stimulating potential of Environment: 8 months		
Floor freedom	.61**	.34**
Toys	.43**	.13
Amount of Play	.14	.04
Stimulating potential of Environment: 11 months		
Floor Freedom	.56**	.57**
Toys	.45**	.41**
Amount of Play	.21	.34*
Quality of Infant-Mother Attachment	.55**	.46**
Maternal Variables		
Verbal Stimulation	.18	.23
Frequency of Punishment	-.24	-.34*
Education	.16	.08

* $P < .05$ ** $P < .01$

Figure Caption

Mean scores on object and person permanence for the positive and negative-no décalage groups at 8-1/2 and 11 months.


person permanence
object permanence
Testing : 8½ months
Positive Décalage Group
NS
p<.05
Stages
4
5a
5b
6a
6b
6c
Negative - no Décalage Group
Testing: 11 months
Positive Décalage Group
NS
p<.05
Stages
4
5a
5b
6a
6b
6c
Negative-no Décalage Group